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# <Note> Chimpanzee Pith-Folding at Toro-Semliki Wildlife Reserve, Uganda

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**Figure 4.** PM (left), AL, RB carrying her infant ventrally, and RC (right) tracked the python.

members of M group, who were a few hundred meters from their location. Some of the females of the focal party remained near the bush for more than 30 minutes, but the python did not appear again.

According to estimates based on the video recording, the python was about 2.8 meters long and 0.08 meter in maximum diameter, and moved at a speed of about 0.27 m/s (= 1.0 km/h).

## DISCUSSION

Chimpanzees in Gombe showed fear and avoidance responses (rushing away, climbing trees) accompanied by loud “wraa” and soft “huu” calls when they detected a nearly dead python placed within the observation area<sup>2</sup>. Chimpanzees in Mahale also expressed “wraa” and “huu” calls, but after watching the python, only “huu” calls, which express puzzlement, surprise, or slight anxiety directed toward such phenomena as small snakes, rustling noises made by unidentified creatures, and so on<sup>6</sup> were heard. Chimpanzees in Mahale also showed fear and avoidance responses (leaping back, climbing on vines, grimacing) to a python, but they were thought to be more interested in the python because they spent more time waiting, watching, and tracking it. Even a mother with her infant held ventrally and a juvenile followed the python despite its status as a potential predator of juvenile and infant chimpanzees<sup>4</sup>.

Many species of primates face a risk of predation from snakes. It has been hypothesized that the need to avoid snakes shaped the evolution of the primate visual system<sup>7</sup>. This hypothesis has been supported by experiments on Japanese monkeys (*Macaca fuscata*) reared with no experience with snakes who rapidly detected a picture of a snake<sup>8</sup>. Wild chimpanzees have been shown to detect and avoid pythons, but they also expressed interest in and approached these creatures. Although many researchers have studied chimpanzees in Mahale over the course 40 years, this is the only case of an encounter between chimpanzees and a python that has been reported. Because the chimpanzees of Mahale may not have been exactly sure about the nature of a python due to their lack of experience with this species, they may have been attracted to and puzzled by it.

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## REFERENCES

1. Yerkes R, Yerkes AW 1936. Nature and conditions of avoidance (fear) response in chimpanzee. *J Comp Psychol* **21**:53–66.
2. van Lawick-Goodall J 1968. The behaviour of free-living chimpanzees in the Gombe Stream Reserve. *Anim Behav Monogr* **1**:161–311.
3. Crockford C, Boesch C 2005. Call combinations in wild chimpanzees. *Behaviour* **142**:397–421.
4. Izawa K, Itani J 1966. Chimpanzees in Kasakati Basin, Tanganyika (I): Ecological study in the rainy season 1963–1964. *Kyoto Univ Afr Stud* **1**:73–156.
5. Nishida T 1990. A quarter century of research in the Mahale Mountains: An overview. In: *The Chimpanzees of the Mahale Mountains*, Nishida T (ed), Univ of Tokyo Press, Tokyo, pp 3–35.
6. Goodall J 1986. *The Chimpanzees of Gombe: Patterns of Behavior*. The Belknap Press of Harvard University Press, Cambridge.
7. Isbell L 2006. Snakes as agents of evolutionary change in primate brains. *J Hum Evol* **51**:1–35.
8. Shibasaki M, Kawai N 2009. Rapid detection of snakes by Japanese monkeys (*Macaca fuscata*): An evolutionarily pre-disposed visual system. *J Comp Psychol* **123**:131–135.

## <NOTE>

### Chimpanzee Pith-Folding at Toro-Semliki Wildlife Reserve, Uganda

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## INTRODUCTION

Chimpanzees daily make and use tools, and most of their tool manufacturing transforms vegetation by stripping, peeling, splitting, crushing, clipping, etc. In habituated populations, behavioural data accompany the artefacts, so that observers see precisely how the tools are made and why. However, chimpanzees also modify detached vegetation when not making tools, and these activities may leave behind puzzling artefacts.

Such are the ‘wadges’ (or ‘quid’) of the pith of the wild date palm, *Phoenix reclinata*, which we analyse in detail here. The artefact is obvious when encountered: A straight stem is bent repeatedly to alternating sides, concertina-style, so that it has a series of folds at acute angles (see Figure 1). These objects are the spat-out products of buccal compression, from which juices have been extracted by squeezing them between tongue and palate.



**Figure 1. Folded pith wadges of *Phoenix reclinata* made by chimpanzees at Toro-Semliki Wildlife Reserve.**

Their 'function' is straight-forwardly nutritional, but the puzzles exist: Why do they take this distinctive shape, and why do so many wadges have an odd number of folds while so few have an even number of folds?

The only previous report of leaf-folding comes from the chimpanzees of Bossou, Guinea, who manufacture water-extracting tools<sup>1-4</sup>. To make these tools, the apes fold sets of 1-4 leaves (mostly of *Hybophrynium braunianum*) at about 3-cm intervals, while stuffing them into the mouth. This device is inserted by hand into a tree-hole containing water, then extracted and sucked, as a source of sustenance. (Such leaf-folding differs from leaf-sponging and leaf-spooning, although all three techniques yield drinking water<sup>3</sup>.)

Wadging entails a nutritious object being manipulated by mouth but not swallowed; it seems to be a universal chimpanzee food-processing technique. Goodall<sup>5</sup> (p. 238) described wadging at Gombe in detail, noting a variety of food-items, mostly fibrous plant-parts, e.g. figs, bark, etc. In some cases, chimpanzees add leaves to fleshy, 'rich'-tasting foods, such as meat, eggs, honey, or over-ripe fruit, to form a compressed, homogenised bolus. This may be swallowed, but usually there is an accumulation of amorphous, jumbled fibre-spheres left on the ground. (Presumably, wadges are ejected rather than ingested, because the fibrous mass of foliage is of low quality and would take up valuable gut space.)

We have found no previous record of accordion-folded wadges from any other species of non-human primate. Here we document these special wadges and seek to infer how the artefacts end up with a non-random design, that is, a prevalence of odd-numbered folds. We predicted that the number of folds is positively correlated with the length of the pithy stem involved; given a standard unit of folding distance, the longer the stem, the more folds required. However, we had no clue a priori about the biased number of folds.

## METHODS

We studied the wild chimpanzees (*Pan troglodytes schweinfurthii*) of the Toro-Semliki Wildlife Reserve, Uganda<sup>6</sup>. If the partly-habituated chimpanzees could not be un-nested at the beginning of the day, we searched

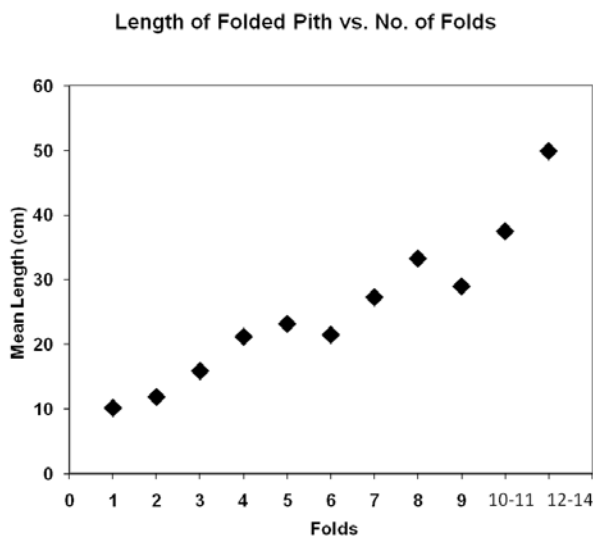
for them, listening for calls and looking for their signs. Once contacted, we stayed with them for as long as possible. These apes occupy a largely open habitat, which is a mosaic of grassland, scrub, open woodland, gallery forest, and swamp. In tracking or following chimpanzees, we noted feeding traces left by them. For wild date palm wadges, we counted the numbers in an assemblage and noted the sources from whence the piths had been detached. Intact and fresh (less than 24 hr old) wadges were collected in plastic ziplock bags and returned to camp for processing. In camp, WCM measured wadges to the nearest 0.5 cm, from fold to fold, and counted the number of folds. Thus, a folded-pith wadge with 'n' folds yielded 'n + 1' measureable segments.

## RESULTS

Remnants of the chimpanzees' wadging of wild date palm were found daily over May-September 2008. A typical assemblage consisted of several mature fronds lying on the ground less than 5 m from the presumed source plant. A source plant was identified by freshly-damaged ends of the still-intact fronds; these were readily apparent because white pith revealed by the damage contrasted with the green outer colour of the foliage. Detached fronds were split length-wise and clipped cross-wise, producing segments of 8-50 cm length. All of the outer epithelium of the segments was peeled away, leaving only the grainy, moist, fibrous pith in strips of less than 1 cm diameter. Few were unused or incomplete strips of pith, by comparison with more than 30 wadges left strewn on the ground (See Figure 1). These artefacts often were concentrated in areas of less than 50 cm diameter, sometimes in a loose pile, as if the wadger had sat still and worked through a set of wadges before moving on. Fresh wadges had a distinctive pale gold colour and were moist; older wadges turned white and shrank in size as they dried. Desiccated wadges also expanded, changing the angles of the folds from acute to obtuse, unless the fibres were tangled up with one another.

How did we know that these artefacts were made by chimpanzees, if we had not seen them being made? Several times observers were within 5 m of chimpanzees wadging palm fibre in thick undergrowth; we glimpsed fragments of their behaviour and heard the distinctive sounds of fronds being detached. We then recovered fresh artefacts from the site only minutes later. Once, a chimpanzee carried fronds into a tree and wadged arboreally. Also, we often saw the chimpanzees wadging other vegetation, e.g. at least 4 species of tree-bark (but all of these wadges were the more typical jumbled balls). Many wild date palm wadges were recovered when we tracked chimpanzees, only minutes ahead of us. We found imprints of knuckle- and hand-prints in association with the wadges. No other animals at the study-site did such wadging, nor were there resident humans present to do so.

We measured 110 wadges to the nearest 0.5 cm. These had 1-14 folds; 56 had 3 folds, making it the modal number. Fully extended, the wadges averaged 15.9 cm long (n = 110, range 8-50, median & mode = 17.5). The mean distance between folds (i.e. length of segment) was 3.8 cm (n = 563, range = 1.5-6.5, median = 3.5, mode =



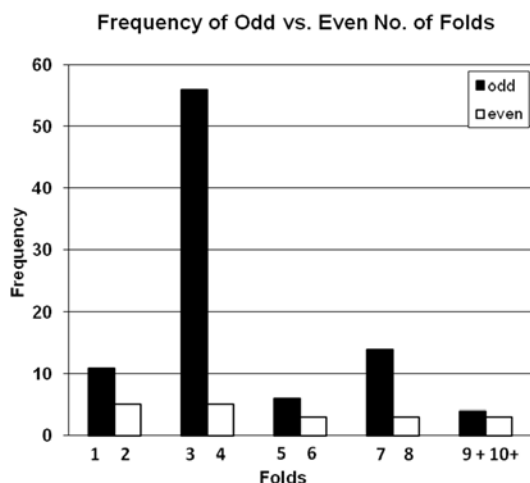
**Figure 2. Average (overall) length of folded pith wadges of *Phoenix reclinata* as a function of number of folds.**

3.0). There was a positive correlation (Spearman's rho,  $n = 11$ ,  $r_s = 0.98$ ,  $p < .001$ , two-tailed) between mean length of wadges and the number of its folds, suggesting that segment-length is relatively standardised (see Figure 2).

Many more wadges had an odd number of folds (1,3,5,7, etc.) than an even number of folds (2,4,6,8, etc.). (See Figure 3) For every adjacent pairing, that is, 1 vs. 2 folds, 3 vs. 4 folds, etc., the prevalence of odd-number folds was greater. Presumably the predominance of 3–4 folds is a function of the preferred overall length divided by the typical segment length (see above). Overall, 91 (83%) wadges had 1–13 odd-numbered folds, while only 19 (17%) had 2–14 even-numbered folds (Binomial test,  $n = 110$ ,  $z = 6.77$ ,  $p < .001$ , two-tailed) (This was not a collection bias, as the number of folds was obscured in the field and could not be ascertained until the artefact was extended back in camp.)

## DISCUSSION

If the implicit interpretation of leaf-folding at Bossou



**Figure 3. Frequency of folded pith wadges with odd versus even number of folds.**

is that the optimal dimension of the fold is a function of the space available in a chimpanzee's mouth, then it makes sense for pith-folding too. The most economical way to pack a linear object into a much smaller space is to compact it to the maximum permissible length, and the most efficient form of compaction is folding. Thus it is notable that the average length of fold of leaves at Bossou was 3 cm versus 3.8 cm for pith-folding at Semliki. So, all other things being equal, the correlation between number of folds and total length of wadges is likely to be a matter of anatomical (buccal) constraints. (Other, leafy wadges are amorphous in shape, but the stiff longitudinal fibres of the pith make folding the better alternative.)

But what about the odd-even difference? Perhaps chimpanzees consistently clipped lengths of pith that when folded to the optimal segment-length of about 3–4 cm were somehow biased toward an odd number of folds. This seems nonsensical. If an ape were sufficiently picky about producing exactly the right number of folds to fill up the mouth, then on average, all other things being equal, one would expect a 50:50 chance of odd or even, given individual variation in buccal volume.



**Figure 4. Jumbled (standard) and folded pith wadges of *Cyperus papyrus* at Kanyawara, Kibale National Park.**

A solution to the oddness riddle emerged serendipitously from chance, unobstructed observations of habituated chimpanzees at another Ugandan field site, Kanyawara, in Kibale National Park. There, chimpanzees wedge the pith of papyrus (*Cyperus papyrus*) stems. They usually produce amorphous, jumbled-mass wadges, but they occasionally fashion concertina-shaped, folded wadges that are identical in form to the Semliki ones (Bertolani, pers. comm.; See Figure 4). The technique is as follows: After clipping the stem to the final length, the ape folds it in half, with one end in the lips and the other in one hand. She then 'feeds' the doubled-over stem into the mouth by the same hand, initial-fold first. Each new fold of the doubled-stem thus produces a pair of folds, which when added to the single initial fold, gives an odd-numbered total. Occasionally, the wadger does not bother with the initial fold, and just 'feeds' the stem into the mouth; presumably these artefacts have a 50:50 chance of ending up with an odd or even number of folds.

To what extent does pith-folding at Semliki resemble



leaf-folding at Bossou? There are several differences<sup>3</sup>: The folded leaf is a tool, the pleats of which increase the water-holding ability of the leaves. The multi-folded pith is not a tool, and the folds seem to have no containing function. So, Semliki wadges are discarded after one use, whereas Bossou's wadges may be re-used up to 122 times. At Semliki, only one species of plant is used for folding; at Bossou at least seven species are used. In making the wadge, at Semliki the raw material is folded over at its centre-point before being 'fed' into the mouth; at Bossou the raw material is stuffed directly into the mouth, starting at one end of the leaf. Most of these differences can be explained by the differing functions of the activities.

On the other hand, there are some similarities: Both procedures modify plant materials in order to fill up the buccal cavity, using folding as a technique to do so. The resulting pleats are evenly and similarly spaced, yielding a concertina-like artefact with alternating folds. The making of both types of artefact involves hand-mouth coordination. Most of these similarities can be explained by the similar biomechanics of the tasks.

Who cares if the number of folds in a wadge is odd or even? One answer is that this is the stuff of culture, not just of gross differences across populations, but also of nuanced variation, when cultural traits are basically similar but subtly different. Such trivial variants are common in human cultures, and the same may be true of non-human artefacts. This ethnographic note reminds us that culture is a layered phenomenon, and that if we operate on one level only, we may miss important features. Another answer is that researchers who work with artefacts, e.g. archaeologists, face challenges in inferring how those artefacts were produced. Ethno-archaeology reminds us how difficult it can be to imagine the absent processes that result in material culture.

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## REFERENCES

1. Biro D, Sousa C, Matsuzawa T 2006. Ontogeny and cultural propagation of tool use by wild chimpanzees at Bossou, Guinea: Case studies in nut cracking and leaf folding. In: *Cognitive Development in Chimpanzees*. Matsuzawa T, Tomonaga M, Tanaka M (eds), Springer, Tokyo, pp 476–508.
2. Sousa C 2011. Use of leaves for drinking water. In: *The Chimpanzees of Bossou and Nimba*. Matsuzawa T, Humle T, Sugiyama Y (eds), Springer, Tokyo, pp 85–96.
3. Tonooka R 2001. Leaf-folding behavior for drinking water by wild chimpanzees (*Pan troglodytes verus*) at Bossou, Guinea. *Anim Cogn* 4:325–334.
4. Tonooka R, Inoue N, Matsuzawa T 1994. [Leaf-folding behavior for drinking water by wild chimpanzees at Bossou, Guinea: A field experiment and leaf selectivity.] *Primate Res* 10:307–313. [Japanese, with English summary]
5. Goodall J 1986. *The Chimpanzees of Gombe: Patterns of Behavior*. Harvard University Press, Cambridge, MA.
6. Hunt KD, McGrew WC 2002. Chimpanzees in the dry habitats of Assirik, Senegal and Semliki Wildlife Reserve, Uganda. In: *Behavioural Diversity in Chimpanzees and Bonobos*. Boesch C, Hohmann G, Marchant LF (eds), Cambridge University Press, Cambridge, pp 35–51.

## <NOTE>

## Preliminary Observations of Hand-Clasp Grooming by Chimpanzees at Bulindi, Uganda

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## INTRODUCTION

The grooming hand-clasp (GHC) was the first documented social custom in wild chimpanzees<sup>1</sup>. It occurs when two chimpanzees seated opposite one another clasp hands overhead and groom each other's underarm with their free hand. The resulting configuration is strikingly symmetrical. Variant forms include one participant grasping their partner's hand or wrist, and 'wrist-to-wrist' in which participants rest their wrists against each other's forearm, usually one partner supporting most of the weight of both<sup>2,3</sup>. The behavior may originate from branch-clasp grooming—a universal behavior in chimpanzees<sup>4</sup>—in which participants grasp an overhead branch whilst grooming socially<sup>1</sup>. GHC has a patchy distribution across Africa. It occurs in more study communities than not (whether present, habitual or customary), yet is notably absent at three long-term sites: Bossou (Guinea), Gombe (Tanzania), and Budongo (Uganda)<sup>4,5</sup>. Records from new study sites are valuable because they increase our understanding of chimpanzee behavioral variation. Here I report preliminary observations of GHC in chimpanzees at Bulindi, Uganda.

## STUDY SITE

Bulindi is a forest–agriculture ecotone, 25-km south of Budongo Forest (Figure 1)<sup>6,7</sup>. I studied a community of ≥ 25 chimpanzees for 18 months during 2006–2008. Although chimpanzees were unhabituated to close observation, from mid-2007 the community's six adult males showed signs of semi-habituation<sup>7</sup>. Consequently, observations of social behavior including grooming and dominance interactions increased as the study progressed.

## OBSERVATIONS

Two instances of GHC were observed in which the identity of participants was confirmed. At 0736 on 29 May 2007 we followed chimpanzee vocalizations to a clearing in heavily logged forest. Four adult males were seated on a rotting log, 27 m distant. Two males immediately climbed down behind the log while two (JL and MR) remained in view, staring with hair erect. Previous short-range encounters with chimpanzees generated alarm